

EOSDIS Core System Project

Interface Control Document Between EOSDIS Core System (ECS) and the Marshall Space Flight Center (MSFC) Distributed Active Archive Center (DAAC)

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Final

July 1995

Hughes Applied Information Systems
Landover, Maryland

Interface Control Document Between EOSDIS Core System (ECS) and the Marshall Space Flight Center (MSFC) Distributed Active Archive Center (DAAC)

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July 1995

Prepared Under Contract NAS5-60000
CDRL Item #029

SUBMITTED BY

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209-CD-009-002

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Preface

This document is a formal contract deliverable with an approval code 1. It requires Government review and approval prior to acceptance and use. This document is under ECS contractor configuration control. Once this document is approved, Contractor approved changes are handled in accordance with Class I and Class II change control requirements described in the EOS Configuration Management Plan, and changes to this document shall be made by Document Change Notice (DCN) or by complete revision.

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Abstract

The primary objective of the Marshall Space Flight Center (MSFC) Distributed Active Archive Center (DAAC) is to provide the basic data sets necessary to describe and understand the physical processes that govern the global hydrologic cycle. The DAAC serves as a primary data center within NASA's Earth Observing System Data and Information System (EOSDIS). The DAAC supports the acquisition, production, verification, archival, and dissemination of remotely sensed and in-situ data sets and their derived higher-order products for the determination of the role of large scale water and moisture processes in the global water budget. This includes the assessment of the amounts of precipitation, cloud water content, total and vertical distribution of water vapor, surface freshwater runoff, evaporation, and evapotranspiration on a regional, continental, and/or global scale. In support of the EOSDIS mission, the DAAC will continue to serve as the primary NASA data center for microwave (active and passive) processing. The MSFC DAAC is a leader within NASA in the processing, archiving and distribution of passive microwave measurements and products from the Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave/Imager (SSM/I) instrument. The DAAC also continues to expand the archive of the Microwave Sounding Unit (MSU) with current atmospheric temperatures anomalies and the implementation of an improved limb correction for the determination of deep layer tropospheric and stratospheric temperatures, and oceanic precipitation. In the FY97-98 time frame the DAAC shall fully support the Tropical Rainfall Measuring Mission (TRMM) in its role as the EOS data archive for the passive microwave TRMM Microwave Imager, the active microwave Precipitation Radar and the TRMM Ground Validation data. In addition, the DAAC will fully support the data processing and archival of the TRMM Lightning Imaging Sensor (LIS).

These interfaces involve a number of internal (ECS-to-ECS) and external (ECS-to-non ECS) sources. This Interface Control Document (ICD) defines the functional and physical design of only certain specific external interfaces within the Marshall Space Flight Center (MSFC) Distributed Active Archive Center (DAAC) for Release A.

In particular, this ICD describes Version 0 System-to-ECS (V0/ECS) data flows, specifically, for ingesting ancillary data products needed to support TRMM standard product generation; as well as internetworking for V0/ECS ancillary data transfer for supporting TRMM standard product generation; and internetworking for V0-to-V1 data migration; and internetworking for V0/ECS interoperability; and internetworking between ECS and the MSFC Campus via external networks.

This ICD includes the precise data contents and format for each interface addressed in this document. All modes (options) of data exchange for each interface are described as well as the conditions required for each mode or option. Additionally, data rates, file sizes, error conditions, and error handling procedures are included. The sequence of exchanges is completely described (i.e., required handshaking). Communications protocols or physical media are also addressed for each interface.

This ICD is consistent with the external systems interface requirements within the MSFC DAAC, as described in the Earth Science Data and Information System (ESDIS) Project -- Level 2

Requirements, the Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System (ECS level 3 requirements) and the Interface Requirements Document (IRD) Between ECS and the Version 0 System.

Keywords: active, ancillary, archive, availability, campus, center, climate, climatology, communications, control, DAAC, DAN, data, datagram, distributed, ECS-V0, FDDI, fiber, file, flows, ftp, GHCC, global, GPCC, GPCP, handshaking, hydrology, hydrologic, interface, kftp, LAN, Marshall, media, moisture, monthly, MSFC, network, notification, physical, precipitation, profile, project, protocols, rainfall, record, release, research, SSM/I, transfer, transmission, transport, TRMM, V0, V0-V1, WAN, water, Wentz

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Change Information Page

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2-1 and 2-2		Final	
3-1 through 3-4		Final	
4-1 through 4-22		Final	
5-1 and 5-2		Final	
A-1 and A-2		Final	
AB-1 through AB-3		Final	
Document History			
Document Number	Status/Issue	Publication Date	CCR Number
209-CD-009-001	Preliminary	January 1995	95-0493
209-CD-009-002	Final	July 1995	

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Abbreviations and Acronyms

1. Introduction

1.1 Identification

This Interface Control Document (ICD), Contract Data Requirement List (CDRL) Item 029, whose requirements are specified in Data Item Description (DID) 209/SE1, is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract (NAS5-60000).

1.2 Scope

This Interface Control Document (ICD) defines the external interfaces (i.e., between ECS and non-ECS components) within the Marshall Space Flight Center (MSFC) Distributed Active Archive Center (DAAC) for the Release A. ECS Releases are keyed to mission support: Release Ir1 provides support to TRMM Early Interface Testing and Science Algorithm I&T. Release A provides support to TRMM Science Operations and TRMM Ground Systems Certification Testing. Release A also provides the functional capabilities needed to support early ESDIS Ground System Testing for the EOS AM-1 and Landsat 7 missions. Release B provides support to EOS AM-1 Mission Operations and Science Operations, and it provides support to ESDIS Ground System Certification Testing for the EOS AM-1 and Landsat 7 missions. Release B also provides archive and distribution services for the Landsat 7 mission. Releases C & D provide evolutionary enhancements to the ECS services provided in the earlier Releases.

In particular, this ICD describes the following:

- (1) Internetworking
 - (a) for V0/ECS ancillary data transfer for supporting TRMM standard product generation
 - (b) for Version 0 (V0)-to-Version 1 (V1) data migration (involving the transfer of data holdings from the EOSDIS Version 0 system to ECS)
 - (c) for V0/ECS interoperability
 - (d) between ECS and the MSFC Campus via the MSFC Isolation Local Area Network (LAN)
- (2) Version 0 System-to-ECS (V0/ECS) data flows, specifically, for accessing ancillary data products to support TRMM standard product generation

This ICD does not include the following:

- (1) Data flows between ECS at the MSFC DAAC and non-ECS systems outside the MSFC DAAC; i.e., TRMM Science Data and Information System (TSDIS). These are addressed in the Interface Control Document Between the EOSDIS Core System (ECS) and TRMM Science Data and Information System.

- (2) Data flows between ECS at the MSFC DAAC and the Lightning Imaging Sensor (LIS) Science Computing Facility (SCF)---these are addressed in the Interface Control Document Between EOSDIS Core System (ECS) and Science Computing Facilities.
- (3) Interfaces between ECS at the MSFC DAAC and ECS at other DAACs (e.g., Langley Research Center, etc.). These internal interfaces (i.e., ECS-to-ECS) are addressed in the EOSDIS Core System (ECS) Internal Interface Control Document for the Science Data Processing Segment (SDPS).
- (4) Data flows for V0-to-V1 data migration ---these data flows are fully addressed in the Version 1 Data Migration Plan White Paper, 1/95.
- (5) Version 0 catalog interoperability data flows; these are included in the Interface Control Document Between the EOSDIS Core System (ECS) and the Version 0 System.

The Earth Science Data and Information System (ESDIS) Project has responsibility for the development and maintenance of this ICD. Any changes in the interface requirements must be agreed to, and assessed at the ESDIS Project Level. This ICD will be approved under the signature of the ESDIS Project Manager.

This document reflects the June 21, 1995 Technical Baseline maintained by the contractor configuration control board in accordance with the ECS Technical Direction No. 11, dated December 6, 1994.

1.3 Purpose and Objectives

This document is written to formalize the interpretation and general understanding of the interfaces between ECS and non-ECS components of the MSFC DAAC. This document provides clarification and elaboration of the ECS/non-ECS systems interfaces at the MSFC DAAC to the extent necessary to assure hardware, software, and operational service compatibility within the end-to-end system.

This document provides a point of mutual control of external interface definitions via the ESDIS Configuration Control Board (CCB).

1.4 Status and Schedule

This is the final ICD for the ECS/non-ECS systems interfaces at the MSFC DAAC which will be implemented in ECS Release A. This ICD has been submitted as an ECS Project CCB approval Code 1 document. At the Government's option, this document may be designated to be under full Government CCB control. Changes may be submitted for consideration by Contractor and Government CCB's under the normal change process at any time.

Within this document are some interfaces that have associated TBRs, TBSs and/or TBDs. A table providing a Work-off Plan is in Appendix A. This plan provides the following information:

- a. ICD I/F Issue No.
- b. ICD Reference Paragraph

- c. ICD Issue Priority
- d. ICD Issue Type - Description
- d. Work-off Plan Task(s)
- e. Projected Resolution Date

1.5 Organization

Section 1 provides information regarding the identification, scope, purpose and objectives, and organization of this document.

Section 2 provides a listing of the related documents which were used as a source of information for this document.

Section 3 provides an overview of the interfaces for ancillary data exchange between the Version 0 System and ECS at the MSFC DAAC. This section also provides a context diagram.

Section 4 includes a detailed discussion of the data exchange framework. Specifically, discussions are provided of the applicable internetworking protocols, network topology, data handshake procedure, control messages (including the purpose, interface methods, formats, error conditions, error handling, and backup methods). File transfers are discussed (including data format, physical media, error conditions, error handling, and backup methods).

Section 5 address the data flows between ECS and the V0 System at the MSFC DAAC. The specific ancillary data products exchanged are identified including product name, file name, frequency, file size, volume and format.

Appendix A contains a table which identifies a Work-off Plan for all TBRs, TBSs and/or TBDs.

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2. Related Documentation

2.1 Parent Documents

The following are parent documents from which this document's scope and content derive:

193-208-SE1-001	Methodology for Definition of External Interfaces for the ECS Project
194-219-SE1-004	Interface Requirements Document Between EOSDIS Core System (ECS) and the Version 0 System
219-CD-006-003	Interface Requirements Document Between the EOSDIS Core System (ECS) and the National Oceanic and Atmospheric Administration (NOAA) Affiliated Data Center (ADC)
301-CD-002-003	System Implementation Plan for the ECS Project
423-10-01-5	Goddard Space Flight Center, Earth Science Data and Information System (ESDIS) Project Level 2 Requirements, Volume 5: EOSDIS Version 0, through CH-01, 9/13/93

2.2 Applicable Documents

The following documents are referenced herein and are directly applicable to this document. In the event of conflict between any of these documents and this ICD, this document shall take precedence.

206-CD-001-002	Version 0 Analysis Report for the ECS Project, Final
305-CD-008-001	Release A SDPS Data Server Subsystem Design Specification for the ECS Project
305-CD-009-001	Release A SDPS Ingest Subsystem Design Specification for the ECS Project
305-CD-012-001	Release A CSMS Segment Communications Subsystem Design Specification for the ECS Project
160-TP-002-001	Version 1 Data Migration Plan [for the ECS Project], Technical Paper
423-33-03	Goddard Space Flight Center, Science Data Plan for the EOS Data and Information System Covering EOSDIS Version 0 and Beyond, Document Version 3, 7/94
none	Goddard Space Flight Center, EOSDIS Version 0 to Version 1 Transition Plan (Draft), 11/23/93
RFC 791	J. Postel: Internet Protocol, 9/81
RFC 793	J. Postel: Transmission Control Protocol, 9/81

2.3 Information Documents

The following documents, although not directly applicable, amplify or clarify the information presented in this document, but are not binding.

209-CD-005-002	Interface Control Document Between EOSDIS Core System (ECS) and Science Computing Facilities (SCF), Final
209-CD-007-002	Interface Control Document Between EOSDIS Core System (ECS) and TRMM Science Data and Information System (TSDIS), Final
604-CD-001-004	Operations Concept for the ECS Project: Part 1-- ECS Overview
604-CD-002-001	Operations Concept for the ECS project: Part 2B -- ECS Release B, Annotated Outline
175-WP-001-001	HDF-EOS Primer for Version 1 EOSDIS (White Paper)
560-203-103	Interface Control Document Between the Sensor Data Processing Facility (SDPF) and the Tropical Rainfall Measuring Mission (TRMM) Consumers.
505-41-14	Goddard Space Flight Center, (TRMM-490-152) Interface Requirements Document Between EOSDIS Core System (ECS) and the Tropical Rainfall Measuring Mission (TRMM) Ground System, 2/95
none	Goddard Space Flight Center, EOSDIS Version 0 Implementation Plan, Version 0.1 (Draft), 1/92
none	Goddard Space Flight Center, EOS Ground System & Operations Project Office, EOS Version 0 Architecture and Operations Concept, Draft, 2/3/92
none	GPCP Satellite Derived (IR) Monthly Rainfall Estimates, (available from MSFC DAAC on-line Product Information System, URL http://wwwdaac.msfc.nasa.gov/userservices/gpcp_readme.html)
none	Global Precipitation Climatology Center Global Precipitation Data Set, (available from MSFC DAAC on-line Product Information System, URL http://wwwdaac.msfc.nasa.gov/userservices/gpcc_readme.html)

3. Interface Overview

The primary objective of the Marshall Space Flight Center (MSFC) Distributed Active Archive Center (DAAC) is to provide the basic data sets necessary to describe and understand the physical processes that govern the global hydrologic cycle. The DAAC serves as a primary data center within NASA's Earth Observing System Data and Information System (EOSDIS). The DAAC supports the acquisition, production, verification, archival, and dissemination of remotely sensed and in-situ data sets and their derived higher-order products for the determination of the role of large scale water and moisture processes in the global water budget. This includes the assessment of the amounts of precipitation, cloud water content, total and vertical distribution of water vapor, surface freshwater runoff, evaporation, and evapotranspiration on a regional, continental, and/or global scale. In support of the EOSDIS mission, the DAAC will continue to serve as the primary NASA data center for microwave (active and passive) processing. The MSFC DAAC is a leader within NASA in the processing, archiving and distribution of passive microwave measurements and products from the Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave/Imager (SSM/I) instrument. The DAAC also continues to expand the archive of the Microwave Sounding Unit (MSU) with current atmospheric temperatures anomalies and the implementation of an improved limb correction for the determination of deep layer tropospheric and stratospheric temperatures, and oceanic precipitation. In the FY97-98 time frame the DAAC shall fully support the Tropical Rainfall Measuring Mission (TRMM) in its role as the EOS data archive for the passive microwave TRMM Microwave Imager, the active microwave Precipitation Radar and the TRMM Ground Validation data. In addition, the DAAC will fully support the data processing and archival of the TRMM Lightning Imaging Sensor (LIS).

These interfaces involve a number of internal (ECS-to-ECS) and external (ECS-to-non ECS) sources, which are depicted in Figure 3-1. There are three basic categories of sources providing these data sets to ECS at the MSFC DAAC, including the following:

- (1) external interfaces inside the MSFC DAAC, between ECS and a non-ECS system (e.g., between ECS and the V0 System at MSFC)
- (2) external Interfaces involving non-ECS sources located outside the MSFC DAAC (e.g., between TSDIS and ECS at MSFC)
- (3) ECS-to-ECS interfaces between the MSFC DAAC and some other DAAC---such interfaces are classified as internal (e.g., between ECS at MSFC and ECS at Langley)

This ICD only addresses data flows which correspond to category 1 (above), and specifically, data flows between the V0 System and ECS, within the MSFC DAAC. In particular, the V0 System at the MSFC DAAC is responsible for providing Special Sensor Microwave/Imager (SSM/I) Wentz Data, Global Precipitation Climatology Project (GPCP) and Global Precipitation Climatology Center (GPCC) ancillary data products to ECS at the MSFC DAAC. ECS supplies the TRMM Science Data Information System (TSDIS) with GPCP, GPCC, and SSM/I Wentz ancillary data for TSDIS product generation. The ancillary products to be delivered are agreed upon by ECS and the V0 System well in advance of the ECS need date. ECS (as the consumer) and the V0 System

(as the provider) engage in a handshaking procedure for exchanging messages and data. Table 3-1 lists all of the system messages exchanged between ECS and the V0 System at the MSFC DAAC for Release A, as well as a description of these messages, the originating system, destination system, and references to other sections of this ICD where detailed descriptions are provided.

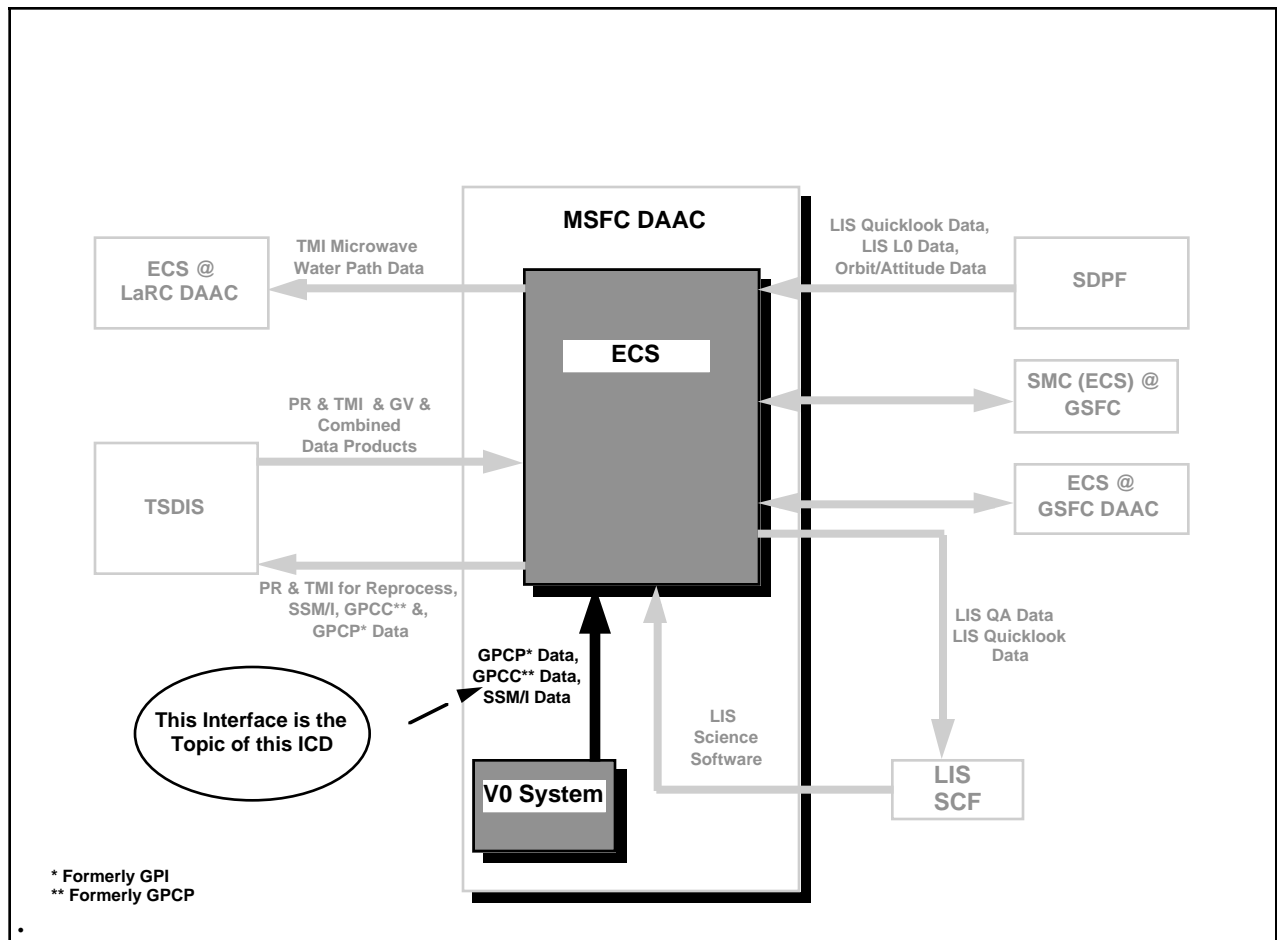


Figure 3-1. Interfaces To ECS At MSFC DAAC-Context Diagram (Release A)

Table 3-1. ECS/V0 System Messages at MSFC DAAC (Release A)

Message	Description	Originating System	Destination System	Paragraph
Authentication Request	Request by Originating System to be authorized by Destination System	V0 System or ECS	ECS or V0 System	4.4.1
Authentication Response	Response to Authentication Request	ECS or V0 System	V0 System or ECS	4.4.2
Data Availability Notice (DAN)	Notification that ancillary data granules have been staged.	V0 System	ECS	4.4.3
Data Availability Acknowledgment (DAA)	Response to DAN, acknowledging receipt of DAN	ECS	V0 System	4.4.4
Data Delivery Notice (DDN)	Announces completion of data transfer and archival	ECS	V0 System	4.4.5
Data Delivery Acknowledgment (DDA)	Response to DDN, acknowledging successful or unsuccessful data transfer	V0 System	ECS	4.4.6

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4. Data Exchange Framework

This section addresses the applicable internetworking protocols (i.e., transport-, network layer-, and physical/datalink protocols) for handling the electronic dissemination of GPCC Global Precipitation, GPCP Monthly Rainfall, and Fleet Numerical Meteorology and Oceanography Center (FNMOC) SSM/I Wentz ancillary data from the MSFC DAAC (V0 System) to ECS. Also included is a discussion of the internetworking between ECS and the MSFC Campus via external networks, internetworking for V0-to-V1 data migration, and internetworking for V0/ECS interoperability. In addition, the handshake procedure, control messages, data exchange (i.e., file transfer), and data exchange security are also addressed herein.

4.1 Internetworking Protocols

ECS provides internetworking services that are based on protocols and standards corresponding to the lower four layers of the Open Systems Interconnection (OSI) Reference Model. Of the four layers, the network and datalink layers play a significant role in defining external interfaces. The physical demarcation points between ECS networks and external networks/systems are ECS routers. The routing software in routers provides network layer services while the interfaces on the router constitute the datalink/physical layers.

4.1.1 Transmission Control Protocol (TCP)

Transmission Control Protocol (TCP) specified in RFC 793, is a connection-oriented, end-to-end reliable protocol designed to fit into a layered hierarchy of protocols which support multi-network applications. It provides for reliable inter-process communication between pairs of processes in host computers attached to networks within and outside ECS.

The interface between TCP and an application process consists of a set of calls much like the calls an operating system provides to an application process for manipulating files. For example, there are calls to open and close connections and to send and receive data on established connections. It is also expected that TCP can asynchronously communicate with application programs such as those based on Distributed Computing Environment (DCE).

4.1.2 Network Layer Protocols

The network layer provides the functional and procedural means to exchange network data units between transport entities over network connections, both for connection-mode and connectionless-mode communications. It relieves the transport layer from concern of all routing and relay operations associated with network connection. The basic function of the network layer is to provide the transparent transfer of data between transport entities.

4.1.2.1 Internet Protocol (IP)

The Internet Protocol (IP), specified in RFC 791 is the network protocol that ECS supports, based on its dominance in industry usage and wide-community support. As part of IP support, Internet Control Message Protocol (ICMP) and Address Resolution Protocol (ARP) is also supported. As the Internet Engineering Task Force (IETF) specified new generation IP becomes available for deployment, it will be supported by ECS networks.

4.1.2.2 Routing

ECS generally uses Routing Information Protocol (RIP) for route exchanges with external networks. Other more robust routing protocols such as Border Gateway Protocol (BGP-4) can also be used depending on the need and center routing policies. The specific routing implementation at MSFC is currently TBD due to the EBnet consolidation.

4.1.3 Physical/Datalink Protocols

The V0 DAAC connects to the ECS MSFC DAAC router via FDDI, using a multimode fiber FDDI Media Interface Connector (MIC) interface (s). Other connections to the MSFC DAAC are currently TBD due to the EBnet consolidation.

4.2 Network Topology

The interface between ECS, NSI, and the MSFC campus occurs at the Global Hydrology Climate Center (GHCC) facility (a separate facility located about 10 miles from the main MSFC campus). The V0 DAAC connects to the ECS MSFC DAAC via an FDDI connection to the internal DAAC router. Connections from the DAAC to other networks are currently TBD due to the EBnet consolidation.

The network topology is depicted in Figure 4-1.

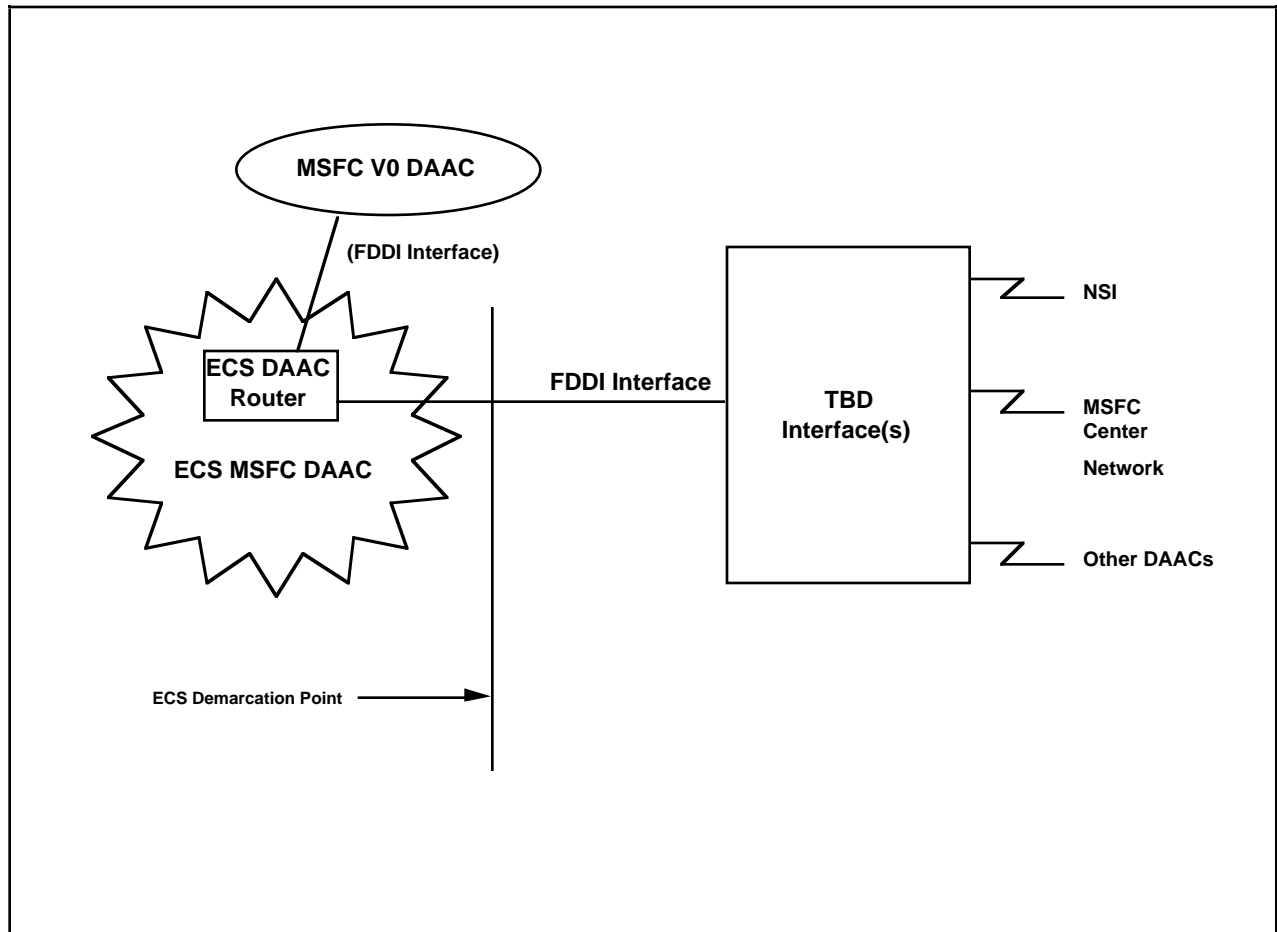


Figure 4-1. Network Interfaces Between ECS, V0, and Campus for MSFC (Release A)

4.3 Data Handshake Procedure

This section describes the handshaking and message sequences involved in exchanging data between ECS and the V0 System at the MSFC DAAC. This handshaking procedure is depicted in Figure 4-2.

1. MSFC DAAC (V0 System) establishes a TCP/IP connection with ECS, and sends an Authentication Request to ECS.
2. ECS responds with an Authentication Response
3. (After successful authentication) MSFC DAAC (V0 System) sends a Data Availability Notice (DAN) to ECS.

4. ECS acknowledges the Data Availability Notice (DAN) by sending a Data Availability Acknowledgment (DAA) to the MSFC DAAC (V0 System)
5. MSFC DAAC (V0 System) terminates the TCP/IP connection.
6. ECS schedules to get the data via kftp, and transfers the files listed in the DAN.
7. (After all files have been successfully archived) ECS establishes a TCP/IP connection with the MSFC DAAC (V0 System),
8. ECS sends the MSFC DAAC (V0 System) an Authentication Request.
9. MSFC DAAC (V0 System) responds with an Authentication Response
10. (After successful authentication) ECS sends MSFC DAAC (V0 System) a Data Delivery Notice
11. MSFC DAAC (V0 System) responds back with a Data Delivery Acknowledgment (DDA).
12. ECS terminates the TCP/IP connection.

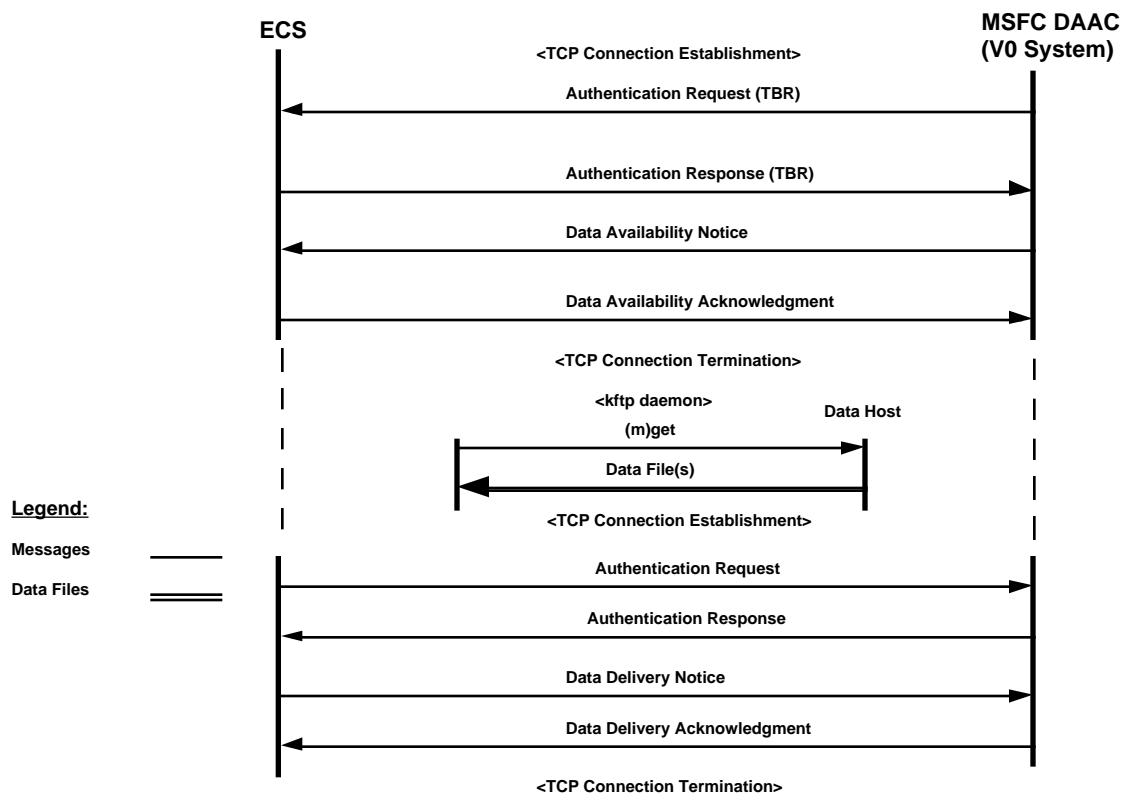


Figure 4-2. Handshake Protocol: ECS Obtains Ancillary Data From V0 System (Release A)

During any given TCP/IP session, it is possible to send more than one DAN or DDN. However additional DANs or DDNs cannot be sent until the acknowledgment is received for the previous message. If a DAN (or DDN) has not been received by the Destination System during the past TBD seconds, the Destination system will assume that the TCP connection has been terminated.

4.4 Control Messages

In general, the transmission of data between ECS and the V0 System at the MSFC DAAC is accomplished by means of a complement of Control Messages which are discussed in this section. Specifically, these control messages include the following:

- Authentication Request
- Authentication Response
- Data Availability Notice (DAN)
- Data Availability Acknowledgment (DAA)
- Data Delivery Notice (DDN)
- Data Delivery Acknowledgment (DDA)

Note: All references in this section to “ECS” or the “V0 System” refer to components located at the MSFC DAAC.

In order to formalize the method of describing these control messages, a number of standardized conventions apply, as follows:

Standardized Conventions:

- Variable length strings are allowed---a NULL character (zero bytes) is used as a field delimiter in a fashion similar to the C Programming Language.
 - ⟨ Field lengths are specified in terms of bytes.
 - ⟨ A byte is equal to an octet (8 bits).
 - ⟨ The specified field size for ASCII strings is the maximum field size---the actual ASCII string may vary in length.
 - ⟨ The order of transmission of a group of octets is the normal order in which they are read in English.
 - ⟨ Whenever an octet represents a numeric quantity, the left most bit in the diagram is the high order or most significant bit.
 - ⟨ Whenever a multi-octet field represents a numeric quantity, the left most bit of the whole field is the most significant bit---the most significant octet is transmitted first.

4.4.1 Authentication Request (TBR)

The Authentication Request, depicted in Table 4-1, is sent from the Originating System to the Destination System once the Originating System has established a TCP connection. The purpose of the Authentication Request is to solicit verification of the Originating System as a valid user, by the Destination System. An Authentication Request is the first message sent by the originator of the TCP session before transmitting any other data transfer message. At various stages during the asynchronous handshaking procedure (depicted in Figure 4-2), authentication of either ECS or the V0 System is required, depending on the particular data transfer message to be sent; i.e., Data Availability Notice (Section 4.4.3) or Data Delivery Notice (Section 4.4.5). For example, if the V0 System intends to send a Data Availability Notice to ECS, the V0 System becomes the Originating System, and this action must be preceded by an Authentication Request sent by the V0 System to ECS. Similarly, ECS must be authenticated by the V0 System prior to sending a Data Delivery Notice.

The TCP connection established by the Originating System is broken in the event that the Authentication Request is rejected by the Destination System. An authentication request fails if any of the following conditions is true:

- ⟨ 'Message Type' is not set to the proper value
- ⟨ 'Message Length' does not contain a value equal to the number of bytes of application data read in for the transmission
- ⟨ 'Destination System' does not equal the identifying string.
- ⟨ 'Originating System' does not equal the identifying string
- ⟨ 'User ID' and 'Password' are not the values expected for the Originating System

4.4.1.1 Interface Method

The Authentication Request is sent electronically from the Originating System to the Destination System via an application program-to-application program TCP connection, where it is analyzed to ensure that it originated from the correct user/application.

4.4.1.2 Format

The format of the Authentication Request Message is defined in Table 4-1.

Table 4-1. Authentication Request Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Authentication Request	Unsigned Integer (1 B)	15
Message Length	Length of Message (L) in Bytes	Unsigned Integer (3 B)	≤ 084
Destination System ID	Communications Server	ASCII String (≤20 B)	processor id
Origination System ID	Communications Client	ASCII String (≤20 B)	processor id
UserID	User-provided identification; assigned by Destination system, encrypted	ASCII(≤20 B)	UserID
Password	Authentication parameter - password assigned to User by destination system	ASCII (≤20 B)	Password

4.4.2 Authentication Response (TBR)

After receiving an Authentication Request and analyzing this request to ensure that it originated from the correct user/application, the Destination System returns an Authentication Response, depicted in Table 4-2, to the Originating System. The Authentication Response indicates the disposition (accept/reject) of the Authentication Request, and completes the authentication process. Only in cases where the Authentication Request has been accepted is the invocation of other messages (e.g., Data Availability Notice or Data Delivery Notice) permitted. For example, if a service has been invoked before authentication has been performed, then an Authentication Response message is returned with a disposition value of 2, indicating rejection.

4.4.2.1 Interface Method

The Authentication Response is sent electronically from the Destination System to the Originating System via an application program-to-application program TCP connection, where it is analyzed to ensure that it originated from the correct user/application.

4.4.2.2 Format

The format of the Authentication Response Message is defined in Table 4-2.

Table 4-2. Authentication Response Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Authentication Response	Unsigned Integer (1 B)	16
Message Length	Length of Message (L) in Bytes	Unsigned Integer (3 B)	≤ 45
Destination System ID	Communications Server	ASCII String (≤20 B)	Same as Origination System in Authentication Request
Origination System ID	Communications Client	ASCII String (≤20 B)	Same as Destination System in Authentication Request
Authentication Disposition	Result of authentication	Integer (1B)	1-accepted 2-rejected

4.4.3 Data Availability Notice (DAN)

A Data Availability Notice (DAN) is sent by the system supplying the data (i.e., the V0 System) to the system ingesting the data (i.e., ECS). Specifically, the DAN is initiated by the V0 System when a new ancillary data granule has been staged on a V0 server, and a link to the granule has been placed in the appropriate product subdirectory of the ECS directory on the V0 server. Its purpose is to announce the availability of ancillary data granules for transfer, including file names, location, and how long these granules will be available in that location. The DAN is sent after the supplying system has been authenticated by the ingesting system. ECS validates the DAN and schedules to pull the data.

4.4.3.1 Interface Method

The DAN is sent electronically from the V0 System to ECS via an application program-to-application program TCP connection.

4.4.3.2 Format

The DAN format is comprised of a message header followed by a Standard Format Data Unit (SFDU) which consists of an Exchange Data Unit (EDU), a Data Availability Notice (DAN) Label, and Parameter-Value Language (PVL) Statements. This message structure is depicted in Figure 4-3. The detailed formats for the message header, EDU Label and DAN Label are defined in Table 4-3. The required DAN PVL parameters are depicted in Table 4-4. The DAN PVL statements are ASCII strings, having at most 256 characters, in the form of: "Parameter = Value." The Value strings shown in Table 4-4 include pre-defined values shown by single quote marks and processor determined values. Processor determined values include ASCII strings, ISO times, and integers to be filled in with appropriate values by a V0 processor during DAN creation. The maximum allowed message length for a DAN is 1 megabyte.

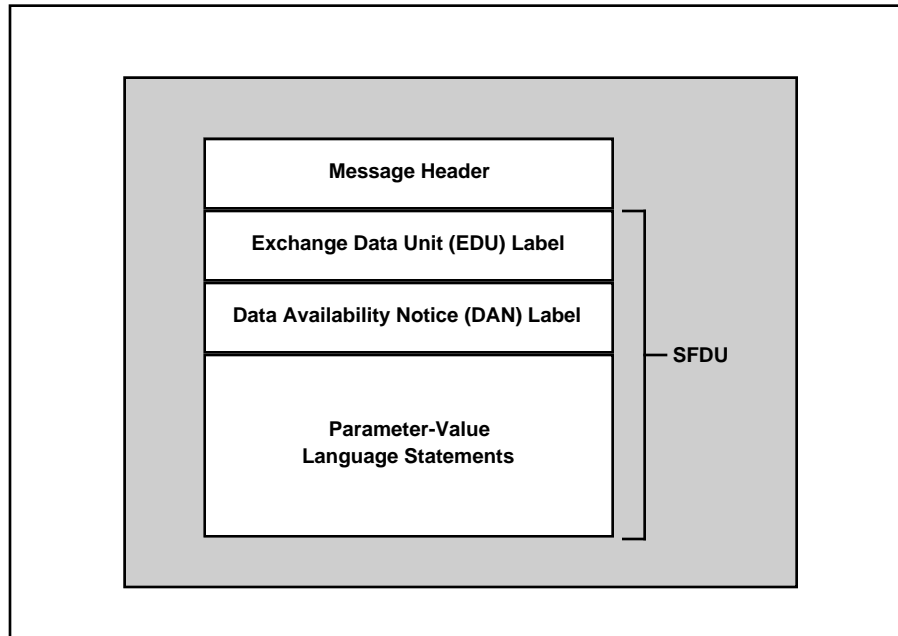


Figure 4-3. Message Structure of Data Availability Notice

Table 4-3. DAN Message Header and SFDU Labels

Message Header (4 Bytes)

Field	Description	Type (Length in Bytes)	Value
Message Type	indicates DAN	Unsigned Integer (1B)	1
Message Length	Length of Message in bytes	Unsigned Integer (3B)	≤ 626

Exchange Data Unit (EDU) Label (20 Bytes)

Field	Description	Type (Length in Bytes)	Value
Control Authority ID	Not used	ASCII (4 B)	"0000"
Version ID	Not used	ASCII (1 B)	"0"
Class ID	Class of label	ASCII (1 B)	"Z"
S1	Not used	ASCII (1 B)	"0"
S2	Not used	ASCII (1 B)	"0"
Data Description	Indicates EDU	ASCII (4 B)	"0001"
Delimitation Parameter	Length in ASCII of PVL statements including white space	ASCII (8 B)	≤ 582

DAN Label (20 Bytes)

Field	Description	Type (Length in Bytes)	Value
Control Authority ID	Not used	ASCII (4 B)	"0000"
Version ID	Not used	ASCII (1 B)	"0"
Class ID	Not used	ASCII (1 B)	"0"
S1	Not used	ASCII (1 B)	"0"
S2	Not used	ASCII (1 B)	"0"
Data Description	Not used	ASCII (4 B)	"0000"
Delimitation Parameter	Length in ASCII of PVL statements including white space	ASCII (8 B)	≤ 582

Table 4-4. Required DAN PVL Parameters (1 of 2)

Parameter	Description	Type (Length in Bytes)	Valid Values
ORIGINATING_SYSTEM	Originator of DAN	ASCII (20 B)	processor identifier
CONSUMER_SYSTEM	Destination of DAN	ASCII (20 B)	processor identifier
DAN_SEQ_NO	Sequence number assigned by originating system	ASCII (10 B)	< 4.296*10 ⁹ (see note)
REQUEST_ID	Identifier of corresponding Data or Subscription Request	ASCII (TBR) (TBD B)	Not used
PRODUCT_NAME	Name of Product which defines the collection of files comprising the product	ASCII (25 B)	V0 Product ID
MISSION	Mission or investigation which includes the sensors producing the data of this notice	ASCII (20 B)	'SSMI', 'GPCC', 'GPCP'
DATA_SERVICE	Type of delivery service which applies for this product	ASCII (12 B)	'Data Availability Notice'
TOTAL_FILE_COUNT	Total number of files to transfer	ASCII (4 B)	0 - 9999
AGGREGATE_LENGTH	Total number of bytes to transfer (sum for all files)	ASCII (10 B)	< 4.296*10 ⁹ (see note)
EXPIRATION_TIME	ISO Time that data can be deleted from originating system	ASCII (20B)	yyyy-mm-ddThh:mm:ssZ, where T and Z are literals (TBD hours after DAN sent)
OBJECT	Start of file group parameters (repeat for each group of files)	ASCII (10 B)	'FILE_GROUP'
DATA_TYPE	V0 Data Type	ASCII (20 B)	'LEVEL2'
DESCRIPTOR	Name of instrument or sensor that collected the data	ASCII (4 B)	'SSMI', 'GPCC', 'GPCP'
DATA_VERSION	Version of data files	ASCII (2 B)	'V1' through 'V999'
OBJECT	Start of file parameters (repeat for each file)	ASCII (9B)	'FILE_SPEC'
NODE_NAME	Name of network node on which the file resides	ASCII (30 B)	e.g.. 'shark.hitc.com'
DIRECTORY_ID	String specifying file directory location (Note:256 bytes including FILE_ID, but excluding null terminator)	ASCII (256 B)	e.g., /SSMI/Level2/ /GPCC/Level2/ /GPCP/Level2/

Table 4-4. Required DAN PVL Parameters (2 of 2)

Parameter	Description	Type (Length in Bytes)	Valid Values
FILE_ID	File name (Note: 256 bytes including DIRECTORY_ID, but excluding null terminator)	ASCII (256 B)	file name
FILE_TYPE	ECS File Data Type	ASCII (20 B)	'SCIENCE', 'BROWSE', 'IMAGE'
FILE_SIZE	Length of file	ASCII (10 B)	< 4.296*10 ⁹ (see note)
BEGINNING_DATE/TIME	ISO Start time of file	ASCII (20 B)	yyyy-mm-ddThh:mm:ssZ, where T and Z are literals
ENDING_DATE/TIME	ISO End time of file	ASCII (20 B)	yyyy-mm-ddThh:mm:ssZ, where T and Z are literals
END_OBJECT = FILE_SPEC	End of file parameters (repeat for each file)		N/A
END_OBJECT = FILE_GROUP	End of file group (repeat for each group of files)		N/A

Note. '<4.296*10⁹' such that it can be accommodated in a 32-bit database field.

4.4.4 Data Availability Acknowledgment (DAA)

The Data Availability Acknowledgment (DAA) is the corresponding handshake/control message for the DAN. The DAA is sent from ECS to the V0 System immediately after ECS has validated the DAN and has scheduled to pull the ancillary data granules which have been staged on the V0 System server. The purposes of the DAA are as follows:

- ⟨ to acknowledge that ECS has received the DAN
- ⟨ tdo indicate the disposition of the received DAN and any associated errors
- ⟨ to identify the status of the data transfer scheduling

There are two forms of DAA, including a short form (Table 4-5) and long form (Table 4-6). The short form is used for both error-free DANs and DANs with header and label errors. The long form is used when some file groups in the DAN have invalid parameters.

4.4.4.1 Interface Method

The DAA is sent electronically from ECS to the V0 System via an application program-to-application program TCP connection.

4.4.4.2 Format

The detailed formats of the short- and long DAA messages are presented, respectively, in Table 4-5 and Table 4-6.

Table 4-5. Short DAA Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Short Data Availability Acknowledgment	Unsigned Integer (1B)	2
Message Length	Length of Message in Bytes	Unsigned Integer (3B)	19
DAN Sequence No.	Sequence number assigned by Originating System	ASCII (10 B)	Supplied in DAN
Disposition	Disposition Bits	Logical Bits (4B)	all 0 - accepted bit 0 - spare bit 1-invalid DAN sequence number bit 2-spare bit 3-invalid mission ID bit 4- spare bit 5-invalid file count bit 6-not used bit 7-other errors bit 8 - EDU label error bit 9 - DAN label error bit 10 - invalid DAN length bit 11 - invalid aggregate length bit 12 - database failures bit 13 - Duplicate DAN bits 14 - 31 spares
Transfer Start Time	Not used	Integer (1B)	Null

Table 4-6. Long DAA Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Long Data Availability Acknowledgment	Unsigned Integer (1B)	3
Message Length	Length of Message (L) in Bytes	Unsigned Integer (3B)	≥ 22
DAN Sequence No.	Sequence number assigned by Originating System	Integer (10 B)	Supplied in DAN
Number of File Groups (to follow)	Number of File Groups with Errors	Integer (4B)	Input file group number

For each file group having errors

Data Type PVL	V0 System Data Type	ASCII String ($\leq 20B$)	Supplied in DAN
Descriptor PVL	Name of instrument/sensor that collected the data	ASCII String ($\leq 60B$)	Supplied in DAN
Disposition	Disposition bits	Logical Bits (2B)	bit 0 - not used bit 1 - invalid data type bit 2 - not used bit 3 - invalid descriptor bit 4 - invalid directory bit 5 - not used bit 6 - not used bit 7 - not used bit 8 - invalid file size field bit 9 - invalid file ID bit 10 - invalid time/data format bit 11 - invalid version number bit 12 - invalid node name bit 13 - invalid file type bit 14 - 15 not used

4.4.5 Data Delivery Notice

A Data Delivery Notice (DDN) is sent from the system which has completed retrieving the files (ECS) via Kerberos File Transfer Protocol (kftp) from the supplier (the V0 System) of the data. The DDN announces the completion of data transfer and archival, and identifies the success of file transfers and any errors or problems that have occurred. There are two forms of the DDN message available for use, including a short (Table 4-7) and a long (Table 4-8) form. The short form of the DDN is used for error-free transfers and mainly communication related errors. If all files in a request do not have the same disposition, a long form of this message is employed. It should be noted that the Data Retrieval Response (DRR) Sequence Number is not used; DRR's apply to a "Put" interface which is not used for ECS-V0 System file transfers.

4.4.5.1 Interface Method

The DDN is sent electronically from ECS to the V0 System via an application program-to-application program TCP connection..

4.4.5.2 Format

The detailed formats of the short- and long DDN messages are presented, respectively, in Table 4-7 and Table 4-8.

Table 4-7. Short DDN Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Short Data Delivery Notice	Unsigned Integer (1B)	11
Message Length	Length of Message in Bytes	Unsigned Integer (3B)	46
DRR Sequence No.	Not used	Integer (4 B)	0000
DAN Sequence No.	Sequence number assigned by Originating System	ASCII (10 B)	Supplied in DAN
Disposition	Successful Network Failure Unable to Establish FTP Connection Host Denied Access All File Groups/Files not found FTP failure - Too many errors in file transfer Post-transfer double-check failed FTP command error	Integer (1 B)	0 1 2 3 4 5 6 7
Spares		(3 B)	
Time Stamp	ISO Time when Destination System transferred the last part of the data	ASCII (20 B)	GMT in the following format: yyyy-mm-ddThh:mm:ssZ, where T and Z are literals
Throughput	Rate in bytes per second averaged over all files	Integer (4 B)	≥0 (0 indicates unsuccessful transfer)

Table 4-8. Long DDN Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Long Data Delivery Notice	Unsigned Integer (1B)	12
Message Length	Length of Message in Bytes	Unsigned Integer (3B)	>22
DRR Sequence No.	Not used	Integer (4 B)	0000
DAN Sequence No.	Sequence number assigned by Originating System	ASCII (10 B)	Supplied in DAN
Number of Files	Total File Count in DAN	ASCII (4 B)	0001 - 9999

For each File

File Directory	ASCII string specifying file directory location	ASCII (≤ 256 B) (including FILE_ID but excluding the null terminator)	Supplied in DAN
File Name	File names on Originating System	ASCII (≤ 256 B) (including DIRECTORY_ID but excluding the null terminator)	Supplied in DAN
File Transfer Disposition	Successful Network Failure Unable to Establish FTP Connection Host Denied Access File not found FTP failure - Too many errors in file transfer Post-transfer double-check failed FTP command error	Integer (1 B)	0 1 2 3 4 5 6 7
Time Stamp	ISO Time when Destination System transferred the last part of the data	ASCII (20B)	GMT in format yyyy-mm-ddThh:mm:ssZ, where T and Z are literals
Throughput	Rate in bytes per second for each file	Integer (4B)	≥ 0 (0 indicates unsuccessful transfer)

4.4.6 Data Delivery Acknowledgment (DDA)

The Data Delivery Acknowledgment (DDA) is the corresponding handshake/control message for the DDN. The DDA is from the V0 System to ECS, and provides the mechanism for the data source to acknowledge successful data transfer and/or data file transfer problems. There are two forms of the DDA message available for use, including a short form (Table 4-9) and a long form (Table 4-10). Typically, the short DDA message is used. However, a long DDA is sent in response to a long DDN. Bit Value 1 is used to acknowledge that the destination system was unable to locate one or more files. Bit Value 2 indicates acknowledgment of all other identified failures.

4.4.6.1 Interface Method

The DDA is sent electronically from the V0 System to ECS via an application program-to-application program TCP connection.

4.4.6.2 Format

The detailed formats of the short and long DDA messages are presented, respectively, in Table 4-5 and Table 4-6.

Table 4-9. Short DDA Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Short Data Delivery Acknowledgment	Unsigned Integer (1B)	17
Message Length	Length of Message in Bytes	Unsigned Integer (3B)	39
DRR Sequence No.	Not used	Integer (4 B)	0000
DAN Sequence Number	Sequence number supplied by Originating System	ASCII (10 B)	Supplied in DAN
Disposition	Successful Files not found Validation failure	Integer (1 B)	0 1 2
Time Stamp	ISO Time when Destination System transferred the last part of the data	ASCII (20 B)	Supplied in DDN

Table 4-10. Long DDA Message Definition

Field	Description	Type (Length in Bytes)	Value
Message Type	Long Data Delivery Acknowledgment	Unsigned Integer (1B)	18
Message Length	Length of Message in Bytes	Unsigned Integer (3B)	≥22
DRR Sequence No.	Not used	Integer (4 B)	0000
DAN Sequence No.	Sequence number assigned by Originating System	Integer (10 B)	Supplied in DAN
Number of Files	Total File Count in DAN	ASCII (4 B)	Supplied in DAN

For each File

File Directory	ASCII string specifying file directory location	ASCII (≤256B) (including FILE_ID but excluding the null terminator)	Supplied in DAN
File Name	File name in ASCII	ASCII (≤256B) (including DIRECTORY_ID but excluding the null terminator)	Supplied in DAN
File Transfer Disposition	Successful File not found Validation failure	Integer (1 B)	0 1 2
Time Stamp	ISO Time when Destination System transferred the last part of the data	ASCII (20 B)	Supplied in DDN

4.4.7 Message Error Handling

During the message exchange between the Originating System and the Destination System, the following broad categories of error conditions may arise:

- ⟨ erroneous message received by Destination System
- ⟨ message not received by Destination System

The approaches for handling errors in these two broad categories are discussed in the paragraphs which follow.

- ⟨ Erroneous Message Received By Destination System - In the event that messages contain errors upon reception, or are received out-of-sequence, they are automatically rejected, and the message destination, accordingly notifies the message source. Specific error conditions corresponding to each of the control messages are described earlier in this section. Typical classes of error conditions in this category include the following:
 - (a) out-of-bound parameter values

- (b) invalid parameter values
- (c) missing parameter values

Furthermore, if an authentication request is rejected, the TCP connection is broken.

- ⟨ Message Not Received By Destination System - Communication link problems may also give rise to failures in message transmission. If a valid control message is not received after an operator-tunable number of attempts an error condition is set and the operator of the sending system informed. ECS and V0 System Operations personnel, in coordination with network personnel, as required, perform the necessary diagnostics to isolate and recover from the problem. The procedure for restarting or resuming the transfer of messages after such a failure is TBD.

In general there is no backup provided for messages sent from the Originating System to the Destination System.

4.5 Data Exchange

The File Transfer is initiated by ECS after it has returned a DAA to the Version 0 System. The file transfer is accomplished electronically using kftp/get or kftp/mget. The format of the ancillary data sets transferred are identified in Section 5.

4.5.1 Error Conditions

During the course of data exchange via kftp, the following errors conditions may arise:

- ⟨ Failure to establish TCP/IP connection
 - Erroneous FTP command

4.5.2 Error Handling/Backup Methods

Should a problem develop during a kftp file transfer, TBD attempts are made to pull the data until the problem has been resolved. In the event that problems cannot be resolved within TBD, ECS and the V0 System operations personnel have the option to coordinate data delivery on 8 mm tapes or 4 mm tapes. While the use of tape media as a backup is not a firm requirement, it may be useful during emergencies, and is supported by both ECS and the V0 System.

4.5.3 Physical Media

Description of physical media is TBD.

4.6 Data Exchange Security

For ECS-V0 System data exchange, file transfer security is achieved by use of Kerberos ftp (kftp), which involves the use of encrypted passwords and user identifiers. Kerberos is described in RFC 1510. It can be applied to any transfer protocol. Kerberos provides authentication without passing passwords in clear text.

Message transfer security is supported by the authentication of each new TCP session, using the Authentication Request and Response (TBR), described in Sections 4.4.1 and 4.4.2, respectively. The ECS gateway performs the authentication check on requests received from the V0 System. The V0 System is responsible for performing the authentication check on requests received from ECS.

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5. Data Flow Descriptions

The data flows between ECS and the Version 0 (V0) System at the MSFC DAAC for Release A are addressed in this section. Well in advance of the need date, ECS and the MSFC DAAC personnel agree on the GPCP Satellite-Derived Monthly Rainfall, GPCC Global Precipitation, and SSM/I Wentz (TBR) ancillary data products needed by ECS to support TSDIS and ECS standard product generation---it should be noted that the final decision on the source of the SSM/I data to be provided to the TRMM science community is undergoing scientific evaluation. The product name, file name, frequency, file size, volume, and format for each of these ancillary products are identified in Table 5-1. ECS and the V0 System at the MSFC DAAC coordinate to deliver the required ancillary products to ECS.

Table 5-1. Ancillary Data Products (Release A)

Product Name²	File Name	Frequenc y	File Size (MB/file)	Approximat e Volume	Format
SSM/I Wentz Data (TBR)	TBS	28 files/day	7	196 MB/day	See (1)
GPCP ³ Satellite-Derived Monthly Rainfall	TBS	1 file/mo.	3.5 (TBR)	3.5 MB/mo.	ad hoc (TBR)
GPCC ⁴ Global Precipitation	TBS	1 file/mo.	1.6 (TBR)	1.6 MB/mo.	ad hoc (TBR)

- (1) Detailed format documented in "Readme" on MSFC DAAC's anonymous ftp server.
- (2) TBR - The definition and completeness of the metadata that will be extracted from these data granules (defined in the same documents as the granules) must be reviewed and validated.
- (3) Formerly GPI [Geostationary Operational Environmental Satellite (GOES) Precipitation Index]
- (4) Formerly GPCP

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Appendix A. Work-off Plan for ECS-MSFC DAAC Release A ICD

ICD Issue #	ICD Para. #	Issue Priority *	ICD Issue Type - Description	Work-off Plan Task(s)	Projected Resolution Date
1	4.1	A	TBD - The network interfaces between ECS, V0 and Campus for MSFC are not defined due to EBnet consolidation.	Work is in progress. ECS is interfacing and participating with EBnet and ESDIS through the following working groups: a. V0 transition working group b. Definitions of network interfaces and requirements working group c. EBnet designers	10/95
2	4.3	B	TBD - The waiting time for receiving DANs or DDNs before a system terminates a TCP connection has not yet been defined.	Coordinate among ECS, MSFC DAAC and ESDIS to obtain agreement.	10/95
3	4.4.1 4.4.2	A	TBR - The implementation method for requesting/receiving authentication has not yet been resolved.	ECS to coordinate, with MSFC and ESDIS, the recommended implementation of Kerberos.	8/95
4	4.4.3 Tbl 4-3 Tbl 4-4	B	TBD - Required DAN PVL Parameters (Table 4-4) contains undefined fields.	Coordinate among ECS, MSFC DAAC and ESDIS to obtain agreement.	10/95
5	4.5.2	B	TBD - maximum number of attempts for pulling data during a kftp file transfer and the maximum allowed time for resolving problems before resorting to tape backup have not yet been defined.	Coordinate among ECS, MSFC DAAC and ESDIS to obtain agreement.	10/95
6	4.5.3	B	TBD - Identification/description of physical media has not yet been defined.	Coordinate among ECS, MSFC DAAC and ESDIS to obtain agreement.	10/95
7	5	B	TBR - The definition and completeness of the ancillary data format and metadata information must be reviewed and validated.	Obtain complete set of documentation on these data from MSFC DAAC.	10/95
8	5	B	TBR - The file size and format of the GPCP and GPCC data products have not yet been resolved.	ECS to coordinate, with MSFC and ESDIS, the recommended implementation of Kerberos.	10/95

* Issue Priority Definition:

A = Design impact. e.g., unresolved interface.

B = Minimal design impact. e.g., content or format of a specific field unresolved.

C = No design impact - administrative detail. e.g., reference document # not available.

Abbreviations and Acronyms

ADC	Affiliated Data Center
ARP	Address Resolution Protocol
BGP	Border Gateway Protocol
CCB	Change Control Board
CCR	Configuration Change Request
CDRL	Contract Data Requirement List
CSMS	Communications and Systems Management Segment
DAA	Data Availability Acknowledgment
DAAC	Distributed Active Archive Center
DAN	Data Availability Notice
DCE	Distributed Computing Environment
DCN	Document Change Notice
DDA	Data Delivery Acknowledgment
DDN	Data Delivery Notice
DID	Data Item Description
DMSP	Defense Meteorological Satellite Program
DRR	Data Retrieval Response
ECS	EOSDIS Core System
EDU	Exchange Data Unit
EOS	Earth Observing System
EOSDIS	Earth Observing System Data and Information System
ESDIS	Earth Science Data and Information System
FDDI	Fiber Distributed Data Interface
FNMOCC	Fleet Numerical Meteorology and Oceanography Center
FTP	File Transfer Protocol
GHCC	Global Hydrology Climate Center
GOES	Geostationary Operational Environmental Satellite
GPCC	Global Precipitation Climatology Center (Germany)

GPCP	Global Precipitation Climatology Project
GPI	GOES Precipitation Index
HDF	hierarchical data format
I&T	integration and test
ICD	Interface Control Document
ICMP	Internet Control Message Protocol
IETF	Internet Engineering Task Force
IP	Internet Protocol
IR1	interim release1
IRD	Interface Requirements Document
kftp	Kerberos File Transfer Protocol
LAN	Local Area Network
LIS	Lightning Imaging Sensor
MB	Megabyte (10^6 bytes)
MIC	Media Interface Connector
MSFC	Marshall Space Flight Center
MSU	Microwave Sounding Unit
N/A	Not Applicable
NASA	National Aeronautical and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NSI	NASA Science Internet
OSI	Open Systems Interconnection
PVL	Parameter Value Language
RFC	Request For Comments
RIP	Routing Information Protocol
SCF	Science Computing Facility
SDPF	Sensor Data Processing Facility
SDPS	Science Data Processing Segment
SFDU	Standard Format Data Unit
SSM/I	Special Sensor Microwave/Imager
TBD	To Be Determined

TBR	To Be Resolved, To Be Reviewed
TBS	To Be Supplied
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TRMM	Tropical Rainfall Measuring Mission (joint U.S.-Japan)
TSDIS	TRMM Science Data and Information System
V0	Version 0